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(71) Applicant: **ITW Limited**
Swansea SA5 4YE (GB)

(72) Inventor: **Cheal, Jonathan Paul Anthony**
Tamworth, Staffordshire B79 7UA (GB)

(74) Representative: **Nash, Keith Wilfrid et al**
KEITH W. NASH & Co.
Pearl Assurance House
90-92 Regent Street
Cambridge CB2 1DP (GB)

(54) Hinged closures

(57) A hinge mechanism for assisting the lifting particularly of a boot lid or tailgate hinged to a motor vehicle body, comprises an inner link (6) and an outer link (8) permitting pivoting of the lid about the body, and a gas strut (10) acting between the fixed hinge part (2) attachable to the body and the movable hinge part (4) attachable to the lid. One end of the strut acts through a pivotable lever (16) whose movement is constrained by engagement with a cam (12) when the two hinge parts are in close proximity, as when the lid is in a lowered position, thereby to cause a lifting movement of the lid.

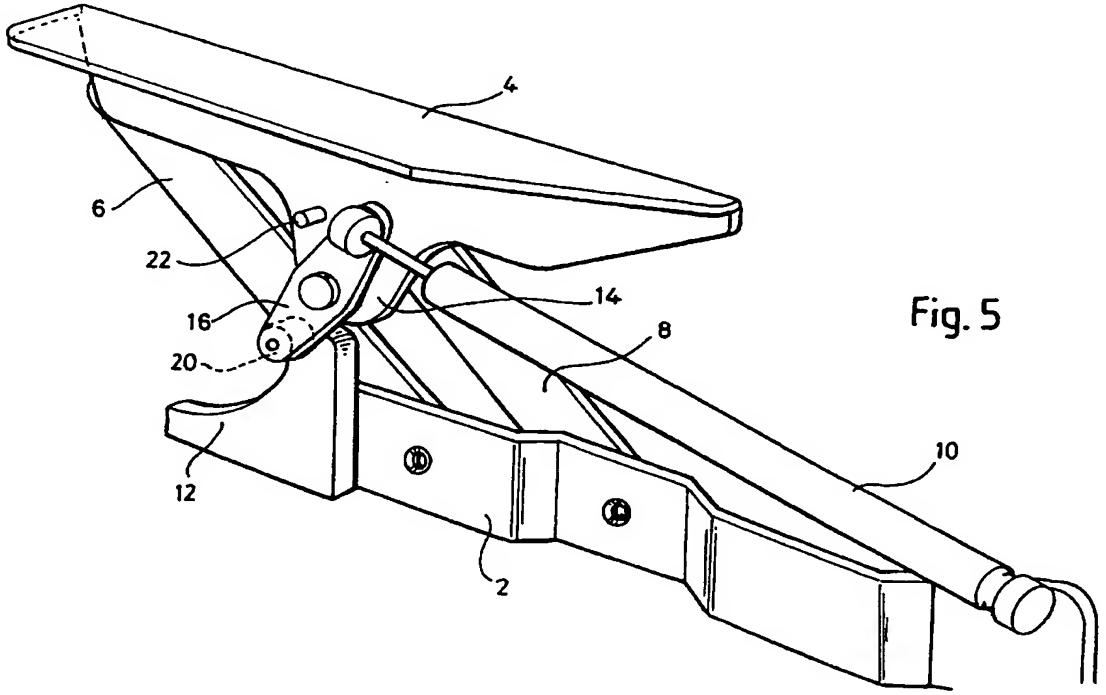

Fig. 5

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Description

Field of the Invention

This invention concerns improvements in mechanisms for assisting the lifting of hinged closures, in particular car boot lids, tailgates and car bonnets.

Background of the Invention

It is becoming increasingly a requirement in the motor industry that car boot lids (i.e. the trunk or rear lid) should need little or no manual effort to be opened. especially starting from the closed position. For example, a person wishing to load luggage or shopping into the boot of a car often has only one hand free, so that the lid has to be unlocked and lifted single handed. This can present a real problem for elderly or infirm persons.

Boot lids for saloon cars, as distinct from the tailgates of so-called hatch-backs, are commonly hinged about a single pivotal axis by means of a so-called swan-neck bracket mounted one on each side of the lid, with springs controlling the weight of the lid. This enables the lid to move clear of the adjacent edge of the body. However this design has the disadvantage that the boot capacity is reduced by the swan-neck brackets, and there is a risk that the intruding brackets may damage high level luggage or other contents of the boot.

To avoid this problem, it has become conventional for boot lids to be pivoted about a pair of multi-link multi-axes hinges. When the lid is closed the hinges collapse to permit their stowage in the shallow gutters on each side of the boot. between the boot seals and the outer body. Assistance in opening the lid is commonly provided by a gas strut acting on each hinge, and since it is undesirable for the struts to intrude into the boot space, it is necessary for them also to be located in the side gutters. Clearly. such an almost horizontal attitude of the struts has conventionally resulted in them providing a poor mechanical advantage, so that the struts can give little assistance during the initial opening of the lid, where the maximum assistance is called for.

It is therefore an object of the invention to provide an improved mechanism for lifting closures such as engine compartments and boot lids.

Summary of the Invention

According to one aspect of the present invention there is provided a hinge mechanism for assisting the lifting of a closure hinged to a body (typically a boot lid or tailgate hinged to a motor vehicle body) comprising: a hinge device permitting pivoting of the closure about the body, and a compressible strut acting between a hinge part attachable to the body and a hinge part attachable to the closure; wherein one end of the strut acts through a pivotable thrust member whose movement is constrained, at least then the two hinge parts are in close proximity (as when the closure is in a lowered position), by engagement of a part thereof with plate means, so as during initial opening of the closure to enable pivoting movement of the thrust member, due to the force of the strut. to cause a lifting movement of the closure.

The plate means may be a straight plate, which is preferably inclined.

Advantageously. however, the plate means is constituted by a cam having a concave cam surface.

The thrust member may comprise a lever pivoted near its centre to a hinged part, one end of the lever carrying a roller engageable with the cam surface. while its other end is pivotally connected to one end of the strut.

In a preferred arrangement the cam is mounted on the hinge part which is attachable to the body, and the thrust member is mounted on the hinge part which is attachable to the closure.

Stop means is preferably provided to limit rotational movement of the thrust member. so that during lowering of the closure the cam engaging part thereof is correctly positioned for engagement with the cam surface.

The compressible strut is preferably a gas strut.

In a preferred arrangement two such hinge mechanisms are provided, one on each side of the closure, such as a bonnet or a boot lid. In particular, the hinge device may be a four-link hinge.

Advantageously the body side hinge part is elongated so that one end of the strut may be pivotally joined to that hinge part, albeit remote from the cam surface.

Preferably the characteristics of the strut, the geometry of the cam and cam follower and the action of the thrust member are selected and arranged such that a positive opening force is applied to the lid throughout its entire opening movement.

Although the mechanism is particularly suited to a car boot lid. it may be equally applied to a bonnet (engine compartment closure/lid) of a motor car. Furthermore. the mechanism may be used in other applications outside the motor industry, wherever assistance in lifting a heavy closure is required.

The invention also resides in a hinge mechanism when fitted to a closure and body, eg of a car.

According to another aspect of the invention a lifting aid comprises a compressible strut for attachment between a closure and a body towards and away from which the closure is pivotally moveable, wherein one end of the strut is adapted to be pivotally attached directly to the body and the other end is pivotally attached to a thrust member which itself is pivotally attachable to the closure, and ramp means is attachable to the body at a position such that the thrust member engages the ramp means at least when the closure and body are in close proximity, so as to convert extension of the strut into lifting of the thrust member relative to the ramp means.

Brief Description of the Drawings

The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a side view, partly schematic, of a conventional multi-link hinge mechanism for a car boot, including a gas strut;

Figure 2 is a view similar to Figure 1 showing such a hinge mechanism in a half-open condition;

Figure 3 is a further view of the conventional hinge mechanism. but in the fully closed condition;

Figure 4 is a side view similar to Figure 3 but on an enlarged scale. showing a modified hinge mechanism in accordance with the invention;

Figure 5 is a perspective view of the hinge mechanism of Figure 4. but in a partly open position;

Figure 6 and 6A are perspective views showing how the invention may be applied to a car bonnet;

Figure 7 is a side view of an alternative cam and cam follower for the mechanism of Figures 4 and 5: and

Figure 8 is a side view of a modified cam arrangement.

Detailed Description of the Drawings

Referring first to the conventional mechanism shown in Figures 1 to 3, a multi-link hinge comprises a fixed member 2 which is intended to be secured to one of the side gutters of a car boot, and a moveable member 4 which is intended to be secured to the lid of the boot. The moveable member 4 is pivoted about the fixed member 2 by an inner link 6, and by an outer link 8, i.e. a link which is on the outer side with regard to the free outer end of the boot lid. In the schematic views of Figures 1 to 3 the links 6 and 8 are only represented by thickened straight lines.

Pivoted to the outer end of the fixed member 2 is one end of a gas strut 10, whose other end is similarly pivoted about an outer end of the moveable members 4.

By comparing Figures 1 to 3 it will be observed that in closing the lid the reactive compressional effect of the gas strut 10 progressively reduces. Thus, as shown in Figure 3, at or near the closed position a small angular movement of the lid. and hence of the moveable member 4, has virtually no effect on the gas strut. It is therefore clear that in attempting to open the boot lid, the gas strut initially provides virtually no assistance to a person wishing to open the lid.

Figure 4 shows an embodiment of the invention which overcomes the above-mentioned problem. The multi-link hinge is substantially the same as in the conventional hinge, and the same reference numerals have been applied. In the modified hinge mechanism of Figure 4, a fixed plate or cam 12, having a specific concave cam profile. is secured to the fixed hinge member 2.

An enlarged lug 14 is formed on the moveable member 4 from which is pivotally mounted a thrust lever 16. Instead of the moveable end of the strut 10 being pivoted about the original point 18 on the moveable member, it is now pivoted about the right hand end of the lever 16. The opposite end of the lever 16 carries a roller cam follower 20 which engages in the cam 12.

Referring now also to Figure 5, this shows the hinge mechanism in the partly open position. In order to prevent excessive anti-clockwise movement of the lever 16 relative to the moveable member 4, there is provided a stop 22 secured to the lug 14 of the moveable member.

It will be apparent that when initially opening the boot lid from the position shown in Figure 4, the cam 12 allows the lever 16 to rotate in an anti-clockwise direction relative to the moveable member 2, thereby enabling the strut 10 to expand and, as a result of the upward reaction on the cam follower 20, to provide the required upward force to at least assist in opening of the lid. By the time the cam follower 20 reaches the upper end of the cam 12 the lever 16 abuts the stop 22, and at this stage the inclination of the strut 10 is sufficiently steep to enable it to continue expanding and to open the lid.

Referring now to Figure 6, this shows how the invention may be applied to a bonnet or front lid of a car. Here the bonnet 24 is hinged to the body of the car by a single-axis hinge device (not shown) at each side of the bonnet. A gas strut 26 holds the bonnet in the open condition shown. Fixedly mounted to the body inside the bonnet compartment is a ramp or cam 28, generally similar to the cam 12 of the previous embodiment of the invention.

A lever 30, similar to the previous lever 16, is pivotally mounted on the inside edge of the bonnet 24, and carries a roller cam follower 32 at its lower end. The other end of the lever 30 is connected to the outer end of strut 26 at a pivot joint 34.

The operation of the mechanism shown in Figure 6 is similar to that previously described. Thus in opening the bonnet 24 from the closed position shown in Figure 6A, the cam 28 enables the strut 26 to rotate the lever 30 and thereby continue to open the bonnet 24.

The pivotal joint 34 of the gas strut is preferably arranged to be readily disconnectable, so that the bonnet can be opened further, for example in the event that major work requires to be performed on the engine inside the bonnet.

The precise shape of the cam 12 and 28 has to be carefully chosen in relation to the hinge geometry, so that a reasonably constant opening force is applied by

the strut to the boot lid or bonnet. Conversely, it is important that the cam allows the boot lid or bonnet to be closed in a smooth manner, and without encountering a sudden increase in the necessary closing force upon engagement of the cam.

Referring now to Figure 7, there is shown a modification of the cam and cam follower of Figures 4 and 5.

Here the cam follower is replaced by an involute gear pinion 4(), while the cam is replaced by an inclined rack 42 with involute gear teeth which mesh with the teeth of the pinion. The bearing for the pinion 40 is arranged to be slightly stiff, so that when the lid of the boot has been fully opened and the pinion has moved away from the rack 42, it will remain in the same rotational position as it was upon leaving meshing engagement with the last tooth of the rack. When the lid is again shut, the pinion will therefore smoothly re-engage with the rack in its previous rotational position.

Operation of the modified hinge mechanism is as described with reference to Figures 4 and 5, the advantage of the modification being that the pinion will start rotating immediately it re-engages with the rack, whereas in the arrangement of Figures 4 and 5 the cam follower 20 may initially tend to skid on the cam surface 12, due to the high perpendicular forces exerted via the gas strut 10.

Figure 8 shows a side view of a modified cam arrangement in place of the one described with reference to Figures 4 and 5. Although similar parts are denoted by the same reference numerals, it should be noted that the mechanism of Figure 8 is opposite-handed to that of Figures 4 and 5.

In the embodiment of Figure 8 the cam 12 of Figures 4 and 5 is replaced by a cam 50 which is pivotally mounted on the fixed member 2 of the hinge at the end remote from the gas strut 10. The cam is biassed in an upward direction by a compression spring 52 which is mounted on the member 2 and locates around a lug 54 disposed approximately mid-way beneath the cam. Although the spring 52 is shown as a coiled compression spring, it could alternatively be replaced by a leaf type spring or even by a rubber block.

In operation, when fully closing the boot lid. the cam follower 20 engages the free end of the cam 50, the spring 52 being in its relaxed extended position as shown. Consequently at this point only a slightly greater closing force is initially encountered.

The necessary force then increases gradually as the cam is pressed downwardly against the spring by the follower 20, although the increase is intigrated by the changing geometry of the lever 16 and strut 10. Conversely, opening of the boot lid also occurs more smoothly, since a greater opening force is initially available.

Particularly in the case of a boot lid, the profile and inclination of the cams 12, 50 or rack 42 and the general geometry of the mechanism may be so arranged that the lid, once released, will open without manual assistance. The catch for the boot lid can then be released remotely from inside the vehicle, without the driver having to go to the back of the vehicle to open the boot lid. Alternatively it may be preferred. eg for safety reasons, that releasing the lid allows the mechanism initially only to open the lid partially. A small manual force will then be required before the mechanism continues to open the lid to the fully open condition.

Claims

1. A hinge mechanism for assisting the lifting of a closure hinged to a body, comprising: a hinge device permitting pivoting of the closure about the body, and a compressible strut acting between a first hinge part attachable to the body and a second hinge part attachable to the closure; wherein one end of the strut acts through a pivotable thrust member whose movement is constrained by engagement of a part thereof with plate means, at least when the two hinge parts are in close proximity (as when the closure is in a lowered position), whereby during initial opening of the closure the plate means enables pivoting movement of the thrust member, due to the force of the strut, to cause a lifting movement of the closure.

2. A mechanism according to claim 1 in which the plate means is secured to the first hinge part.

3. A mechanism according to claim 1 or claim 2, in which the plate means is an inclined straight plate.

4. A mechanism according to claim 1 or claim 2 in which the plate means is constituted by a cam having a concave cam surface.

5. A mechanism according to claim 4 in which the thrust member comprises a lever pivoted near its centre to a hinge part, one end of the lever carrying a cam follower engageable with the cam surface, while its other end is pivotally connected to one end of the strut.

6. A mechanism according to claim 4 or claim 5 in which the cam is mounted on the hinge part which is attachable to the body, and the thrust member is mounted on the hinge part which is attachable to the closure.

7. A mechanism according to claim 1 or claim 2 in which the plate means comprises a toothed rack with which a gear pinion is engageable, the pinion being rotatably mounted at one end of the thrust member.

8. Apparatus according to any of claims 1 to 6 in which

the plate means comprises a cam which is pivoted about the first hinge part and means for biassing the cam in an upward direction.

9. Apparatus according to claim 8 in which the cam is pivoted at one end which is remote from the compressible strut.

10. Apparatus according to claim 8 or claim 9 in which the biassing means is a coiled compression spring.

11. A mechanism according to any one preceding claim and further comprising stop means to limit rotational movement of the thrust member, so that during lowering of the closure the relevant part of the thrust member is correctly positioned for initial engagement with the plate means.

12. A mechanism according to any one preceding claims in which the compressible strut is a gas-filled strut.

13. A hinge mechanism according to any one preceding claim in which the first hinge part is elongated. and in which one end of the strut is pivotally joined to the end of the first hinge part remote from the plate means.

14. A hinge mechanism according to any one preceding claim in which the hinge device is a four-link hinge.

15. A hinge mechanism according to any one preceding claim in which the characteristics of the strut, the geometries of the cam and cam follower and the action of the thrust member are selected and arranged such that a positive opening force is applied to the closure throughout its entire opening movement.

16. A hinge mechanism according to any one preceding claim when fitted to a lid closure and body of a motor vehicle.

17. A hinged closure having a hinge mechanism according to any one preceding claim mounted on each side of the closure.

18. A lifting aid comprising a compressible strut for attachment between a closure and a body towards and away from which the closure is pivotally moveable, wherein one end of the strut is adapted to be pivotally attached directly to the body and the other end is pivotally attached to a thrust member which itself is pivotally attachable to the closure, and ramp means is attachable to the body at a position such that the thrust member engages the ramp means at least when the closure and body are in close proximity, so as to convert extension of the strut into lifting of the thrust member relative to the ramp means.

19. A hinge mechanism or a lifting aid substantially as herein described with reference to, and as illustrated in, Figures 4 to 8 of the accompanying drawings.

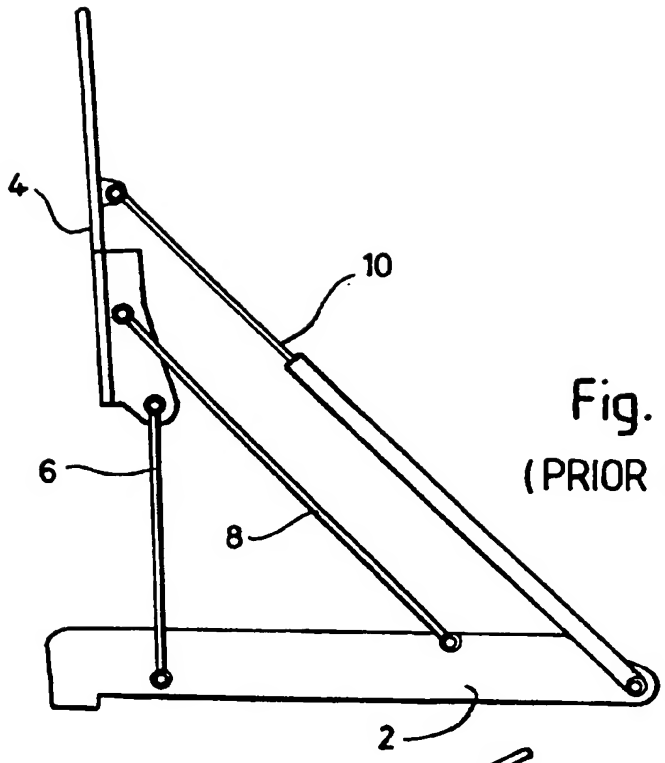


Fig. 1
(PRIOR ART)

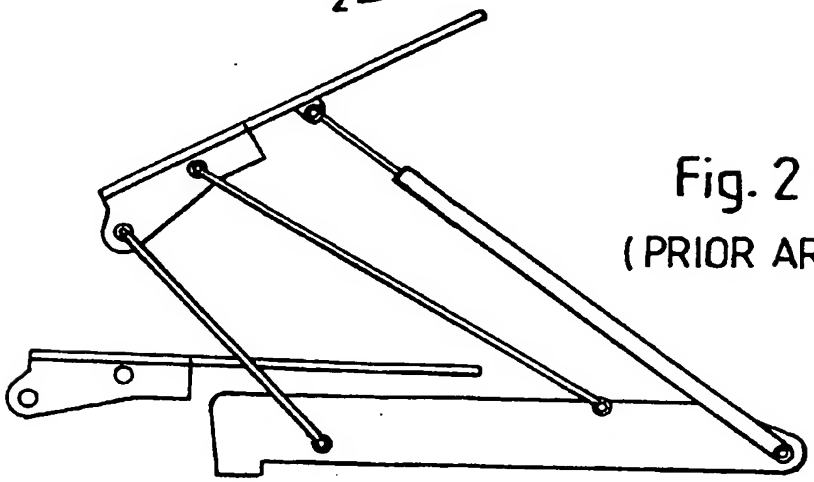


Fig. 2
(PRIOR ART)

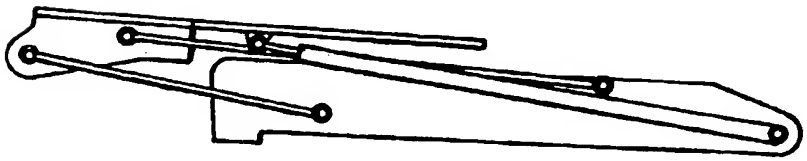


Fig. 3
(PRIOR ART)

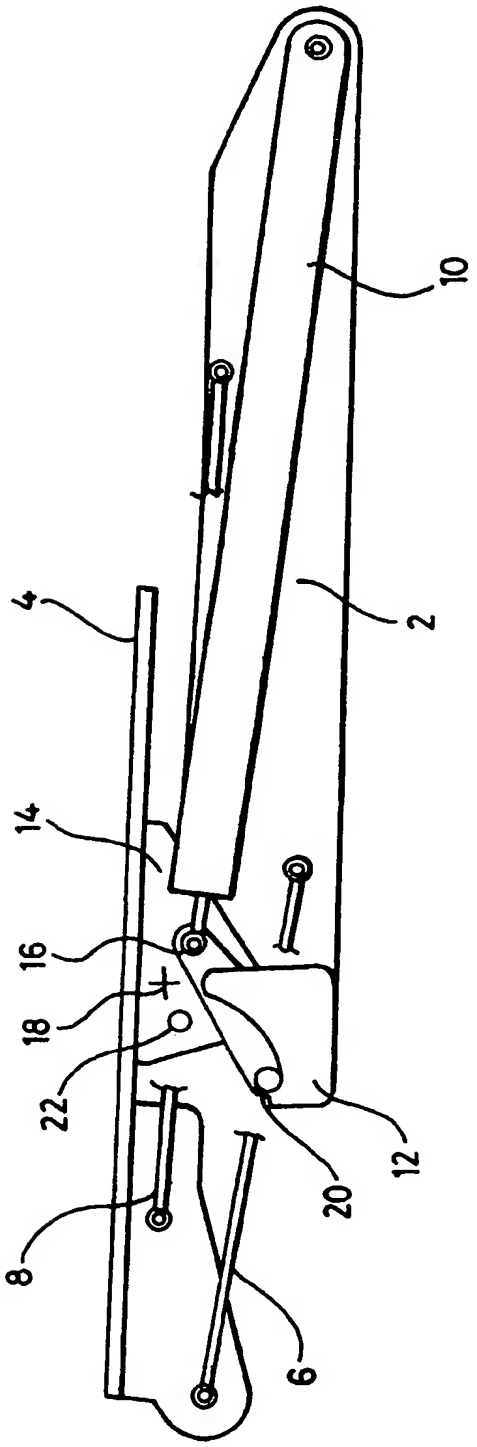
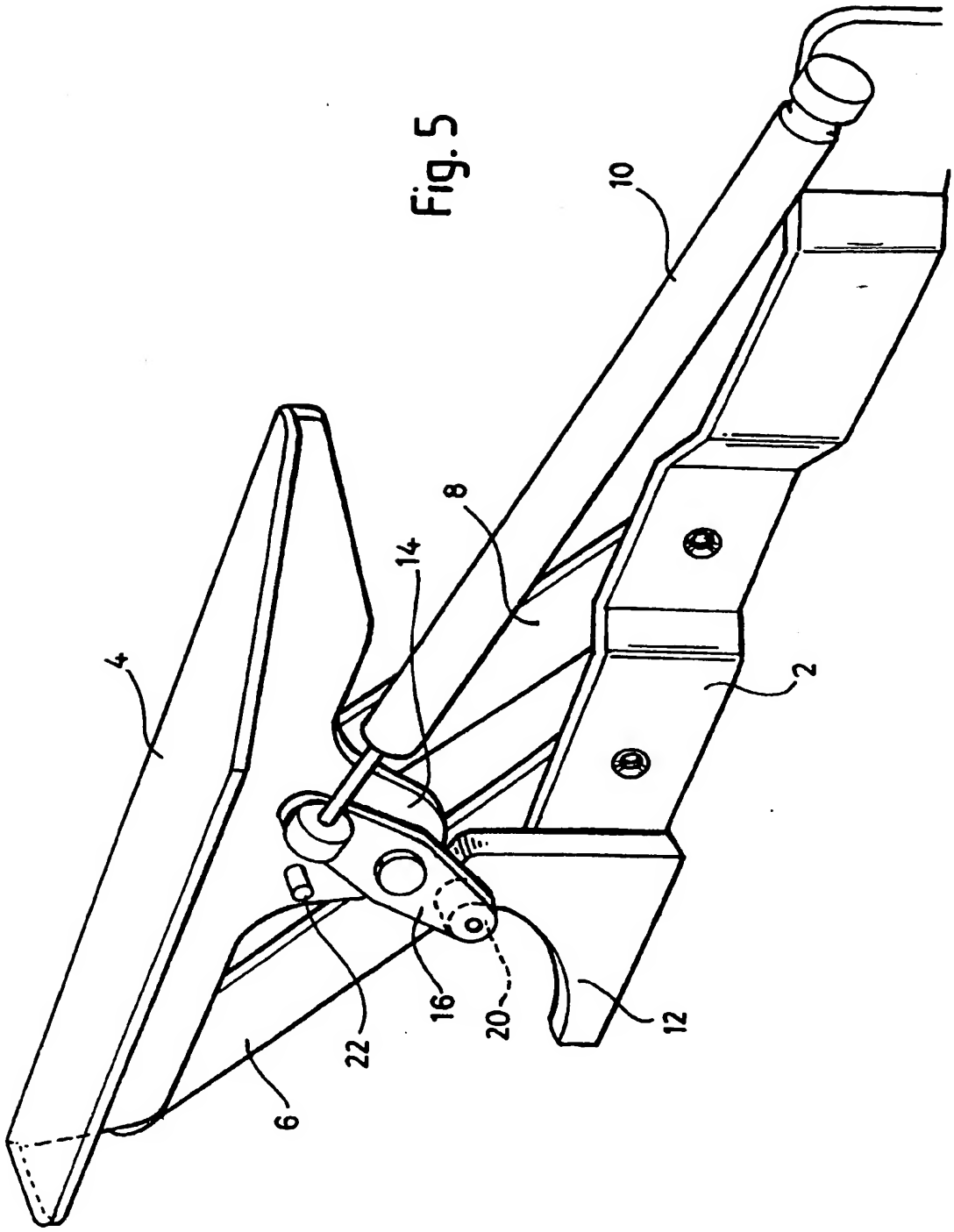


Fig. 4

Fig.5



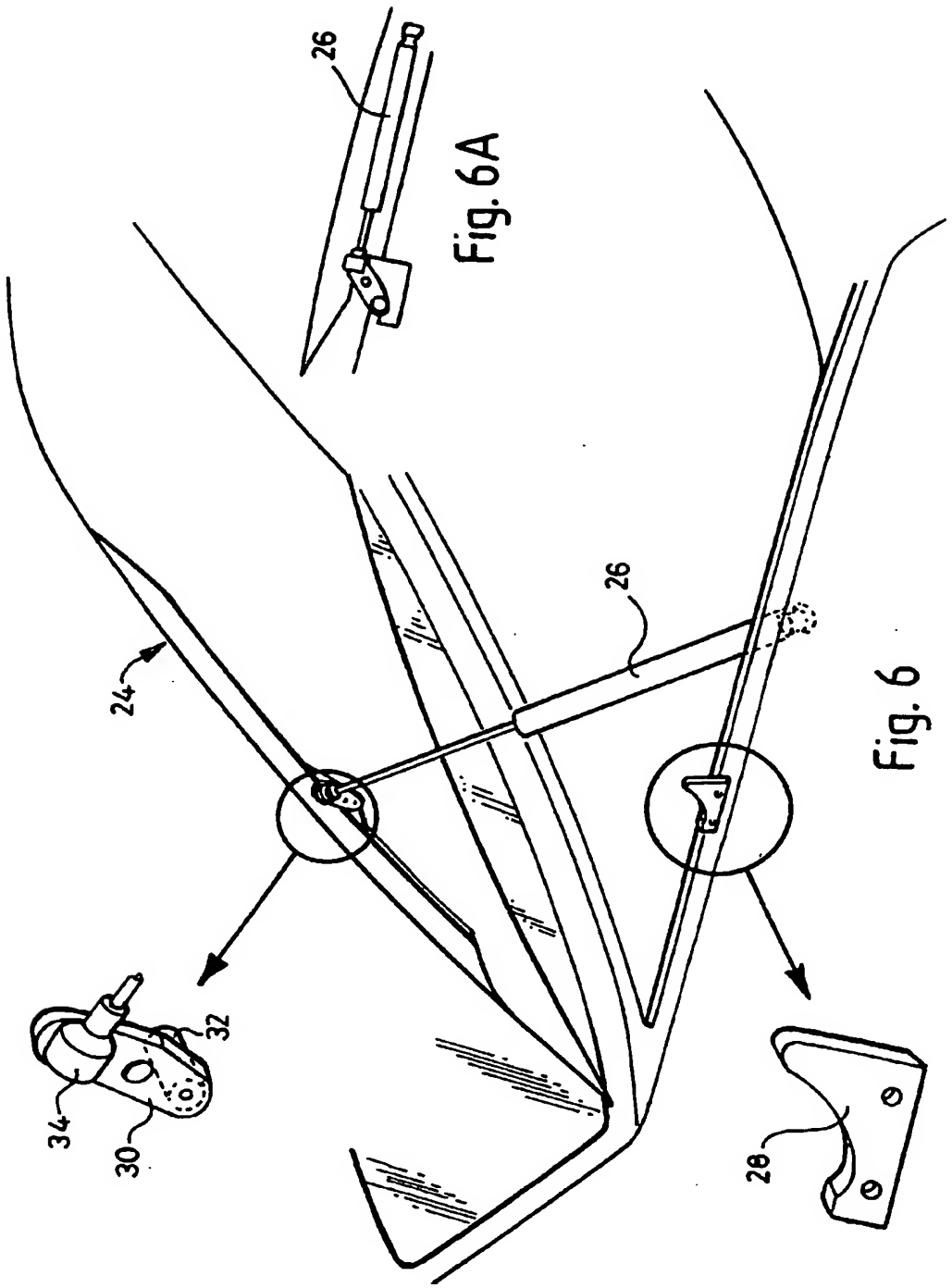


Fig. 6A

Fig. 6

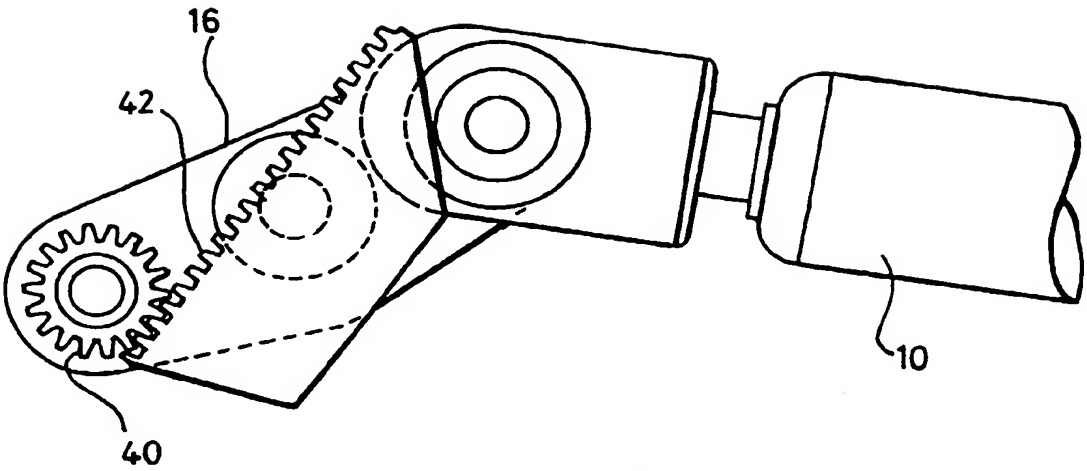


Fig 7

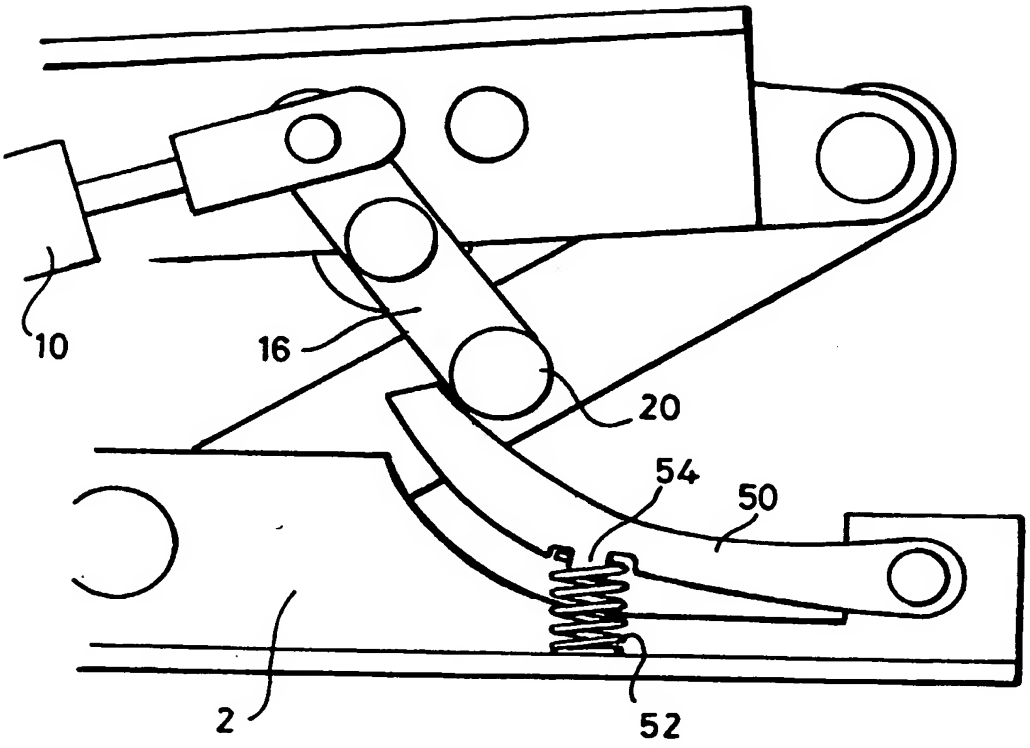


Fig. 8